

This M. of O. Sheet was prepared from Issue 14 of T-502173.

METHOD OF OPERATION  
SELECTOR CIRCUIT

Incoming from Spl. "A" Switchboard With No Test Keys At "A" Position. Panel Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

This circuit is used to establish connections for calls incoming from an "A" switchboard in a full mechanical office. It is used by the zero operator in verifying persistent busy reports and re-establishing cut-off connections.

2. WORKING LIMITS

None.

OPERATION

3. PRINCIPAL FUNCTIONS

This circuit selects an idle sender and establishes connections between the "A" operator's cord circuit and a final selector. Its principal functions are as follows:

- 3.1 Selection of idle sender and proper idle final selector, repeating pulses from final during final selection and dismissing sender at end of selection.
- 3.2 Establishing the talking connection.
- 3.3 Returning to normal.

4. CONNECTING CIRCUITS

This circuit connects with an intercepting and zero operator's cord circuit, an incoming trunk sender and a final selector.

DESCRIPTION OF OPERATION

5. SENDERHINTING

When the zero operator inserts the plug of a cord in the outgoing jack, the (SL) relay operates over the sleeve thru its winding in series. The

(SL) relay operated, lights the 2-J busy lamps, which remain lighted until the circuit returns to normal. The (PLS) relay also operates over the tip and ring of the cord. The (PLS) relay operated, operates the (REL) relay which in turn operates the (L) relay thru its secondary (800 ohm) winding. The (L) relay operated, locks thru its primary (1200 ohm) winding to ground on cam I and operates the R magnet, advancing the switch to position 2. As the switch enters position 1 3/4, the (L) relay locks thru its primary winding to ground in the associated sender circuit over the test lead (TST) if the selector is on a busy sender and the (P) relay operates, opening the operating circuit for the (L) relay. The (P) relay operated, locks to ground on the armature of the (REL) relay and operates the sender selector stepping magnet (SEL.STP), starting the selector hunting for an idle sender. When an idle sender is found the (L) relay releases as there is now no ground on the test lead (TST). The (L) relay released, puts ground on the TST lead making it busy to other hunting selectors and operates the R magnet, advancing the sequence switch to position 3. In positions 2 3/4 to 11, the sender is made busy by ground on the armature of the (P) relay. When the sequence switch enters position 3, the (CI) relay operates. The (CI) relay operated connects the I, REG, FT, FR and CI leads thru to the sender.

#### 6. TRANSFERRING THOUSANDS REGISTRATION

While the selector is hunting for an idle sender, the zero operator may dial the thousands digit in which case the (PLS) relay releases and reoperates in synchronism with the impulses sent out by the dial. The (REL) relay being a slow release relay, remains operated, causing the TH-STP magnet to operate and release with each impulse from the dial thus setting up the thousands digit on the TH register. The (ADV) relay operates and being slow release relay remains operated while the impulses are being sent out by the dial. Each time the (PLS) relay releases, the (B) relay operates thru the break contacts of the TH-STP magnet. The (B) relay operated, (a) connects ground to the (REL) relay thus preventing it from momentarily releasing during dialing (b) connects ground to the TH-STP magnet thus insuring its operation in case the impulses from the (PLS) relay are not of sufficient duration. The (B) relay remains operated until the TH-STP magnet has operated, at which time it releases. The (ADV) relay operated, short circuits the inductive winding of the (TR) relay, preventing it from operating as the TH-2 brush steps off normal. After the digit has been dialed the (ADV) relay releases, allowing the (TR) relay to operate. The (TR) relay operated, (a) transfers the impulse lead from the TH-STP magnet to the I lead of the sender (b) connects battery to the TH-4 TH-5 and TH-6 registers which set up the register relays in the sender over leads REG, FT and FR, as determined by the setting of the TH register.

## 7. BRUSH SELECTION

The succeeding digits registration is set up on registers in the sender. As soon as the first impulses of the hundreds digit is dialed, the sender functions and connects ground to lead CI, operating the (CI-1) relay. The (CI-1) relay operated, (a) holds the (TR) relay operated to ground on the CI lead (b) disconnects the battery used in thousands registration from the TH-4, TH-5 and TH-6 registers (c) operates the TH-STP magnet thru the TH-1 brush and off-normal terminal under control of its break contact stepping the register to normal (d) operates the (CI-2) relay. The (CI-2) relay operated, disconnects the REG, FT and FR leads from the arcs of the TH register and connects the FT and FR leads for brush selection and the REG lead for registration of the succeeding digits.

## 8. BRUSH SELECTION CONTINUED

When the FT and FR leads are closed thru to the sender, the (L) relay operates in a circuit from battery through its primary winding cam F, (CI-2) relay operated, brush 4, over lead FT, thru the sender, back over lead FR, brush 5, (CI-2) relay operated, to ground on cam I. The (L) relay operated locks over cam N and the fundamental circuit, advances the sequence switch to position 4, and operates the UP magnet. As the selector moves upward, ground from the A commutator is intermittently connected to the FT lead, causing the stepping relay in the sender to release and re-operate until the proper brush has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened in the sender, releasing the (L) relay. The (L) relay released, releases the UP magnet stopping the upward movement of the selector and advances the sequence switch to position 5. With the sequence switch in position 5, the trip magnet (TM) operates.

## 9. GROUP SELECTION

After hundreds registration has taken place in the sender and with the sequence switch in position 5, the fundamental circuit is again closed over leads FT and FR operating the (L) relay. The (L) relay operated (a) locks thru cam N and over the fundamental circuit (b) operates the UP magnet for group selection. The trip magnet (TM) being operated in position 5 to 7 causes the previously selected set of brushes to trip as the selector moves upward. Ground is intermittently connected to the FT lead by the B commutator, causing the stepping relay to release and re-operate until the proper group has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay. The (L) relay released, releases the UP magnet thus stopping the brushes at the selected group and advances the sequence to position 7. The (L) relay re-operates in position 7 thru its secondary winding to ground on cam M and advances the sequence switch to position 8. Should the first trunk of the selected group be idle, as

the sequence switch enters position 8, the (L) relay releases but should the first trunk of the group be busy, the (L) relay locks thru its primary winding to ground on the sleeve of the busy trunk.

10. TRUNK HUNTING

The (L) relay held operated in position 8, operates the UP magnet, causing the selector to travel upward. The (L) relay is held operated between terminals thru its secondary winding to ground on the C commutator. When an idle trunk is found, the (L) relay releases there is no ground on the sleeve terminal. The (L) relay released, releases the UP magnet, stopping the brushes on the selected trunk terminals and advances the sequence switch to position 9. The (L) relay released ground the sleeve of the trunk making it busy to other hunting selectors. In position 8 3/4 to 16 1/4 the trunk is made busy by ground on cam I.

11. SELECTION BEYOND

With the sequence switch in position 9, the (L) relay operates thru its primary winding to ground on cam I. The (L) relay operated, locks over the ring to ground in the final selector and advances the sequence switch to position 10. In position 10 the tip side of the fundamental circuit is closed to the tip terminal of the selected final trunk for selection beyond.

12. TALKING

When the selection beyond has been completed, ground is removed from the ring in the final, releasing the (L) relay. The (L) relay released, advances the sequence switch to position 11, the A cam advancing it to position 16 thereby connecting the tip and ring thru to the cord circuit for talking. With the sequence switch in positions 11 to 18, the high resistance winding of the (SL) relay is short circuited, thus operating a marginal relay in the cord circuit which connects talking battery to the tip and ring.

13. SENDER RELEASED

When the sequence switch leaves position 10, the (PLS) relay releases, releasing in turn the (REL), (P), (CI), (CI-1), (CI-2) and (TR) relays. The sender is now disconnected from this circuit.

14. REGULAR DISCONNECTION

When the plug of the zero cord is removed from the jack, the (SL) relay releases. The (SL) relay released, advances the R switch to

position 18. In position 18, the down (D) magnet operates, returning the selector brushes to normal. When the brushes reach the bottom of the frame, ground on the Y commutator advances the sequence switch to normal.

15. OVERFLOW

Should all the trunks in a group be busy, the selector while trunk hunting (in position 8) goes to the top of the group and rests on the overflow terminals. As the sleeve of the overflow terminals is not grounded, the (L) relay releases, releasing the UP magnet and advancing the switch to position 9. Ground on the Z commutator advances the sequence switch to position 12, the A cam advancing it to position 16. In position 16, the Z commutator advances the switch to position 17. In position 17, the #160 or #149 interrupter and 500 ohm resistance are connected across the tip and ring thereby flashing the supervisory lamp in the cord circuit as an indication that all the trunks in the group are busy. When the plug of the cord is withdrawn from the jack, the (SL) relay releases and advances the sequence switch to position 18. From this point on, the switch and selector are returned to normal as described in paragraph 14.

16. TELL-TALE

Should the selector travel to the top of the frame during selection, ground on the X commutator advances the switch to position 10. As the ring is not connected thru to a final the (L) relay releases and advances the switch to position 11, ground on the X commutator advancing it to position 17. In position 17, the supervisory lamp in the cord circuit flashes and the circuit returns to normal when the plug of the cord is withdrawn from the jack as described under paragraph 15.

17. SELECTING A BUSY LINE (WHERE "NO TEST" FEATURE IS USED.)

If the operator desires to establish a connection with a busy line, the 69-A multiple key is depressed, operating the (NT) relay. The (NT) relay operated, (a) locks in position 1 3/4 to 11, (b) in position 10 connects the secondary winding of the (L) relay and the 500 ohm resistance (F) in parallel with the primary winding of the (L) relay which is locked over the ring to ground thru a marginal relay in the final. The marginal relay (P.B.X.) in the final, due to the low resistance of the parallel combination, operates and causes the final to omit the busy test. When ground is removed from the ring in the final, the (L) relay releases, advancing the sequence switch and causing the circuit to function as in paragraph 12. If "No Test" Feature is not used omit paragraph 17.

**18. DISCONNECTION BEFORE CALL IS COMPLETED**

Should the plug of the cord be withdrawn from the jack in any position from 3 to 17 of the sequence switch, the (SL) relay releases, advancing the switch to position 18, the switch and Selector being restored to normal as described under paragraph 14.

ENG: J.C.G.      CHK'D. BY: J.I.      APP'D: H. L. MOYNES  
January 26, 1925.      E.R.C.  
GO

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY

|                 | <u>OPERATE</u>   | <u>NON-OPERATE</u> | <u>RELEASE</u>     |
|-----------------|--|--------------------|--------------------|
| 178-AD<br>(ADV) | Special requirements to insure slow release.<br>After a soak of approximately.<br>.900 amp.<br>Readj. .107 amp.<br>Test .113 amp.<br>W.C.C. .640 amp.<br>Hold:<br>W. C.C..371 amp. |                    | (On open circuit). |

NOTE: To prevent chattering, the "make-before-break" spring combination of this relay shall be so adjusted that the spring which normally makes on the back contact, will give the greatest possible contact pressure against the back contact.

|                 |  |  |                                     |
|-----------------|--|--|-------------------------------------|
| 178-AH<br>(REL) | Special requirements to insure slow release.<br>Readj. .018 amp.<br>Test .019 amp.<br>W.C.C. .041 amp. |  | Readj. .001 amp.<br>Test .0009 amp. |
|-----------------|--|--|-------------------------------------|

NOTE: To prevent chattering, the "make-before-break" spring combination of this relay shall be so adjusted that the spring which normally makes on the back contact, will give the greatest possible contact pressure against the back contact.

|                        |  |  |                                    |
|------------------------|--|--|------------------------------------|
| E530<br>(CI-1)<br>(NT) | Readj. .013 amp.<br>Test .017 amp.<br>W.C.C. .021 amp. |  | Readj. .002 amp.<br>Test .001 amp. |
|------------------------|--|--|------------------------------------|

|  |   |                                     |  |
|--|---|-------------------------------------|--|
| E533<br>(L)<br>Inner<br>wdg.<br>(1230<br>ohms) | Special requirements to insure fast operation.<br>Readj. .017 amp.<br>Test .0178 amp.<br>W.C.C. .018 amp. | Readj. .012 amp.<br>Test .0114 amp. |  |
|--|---|-------------------------------------|--|

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY

|  | <u>OPERATE</u>  | <u>NON-OPERATE</u>                  | <u>RELEASE</u>                      |
|--|---|-------------------------------------|-------------------------------------|
| Outer<br>Wdg.<br>(800<br>ohms).                  | Test .045 amp.<br>W.C.C. .053 amp.  |                                     |                                     |
|  | NOTE: Relay to be equipped with special armature stop<br>(piece part 163914) unless an E1 relay cover is<br>furnished .               |                                     |                                     |
| E827<br>(PLS)<br>Inner<br>Wdg.<br>(500<br>Ohms). | Special Requirements to insure fast operation.<br>Readj. .0145 amp.<br>Test .015 amp.<br>W.C.C. .026 amp.                             | Readj. .013 amp.<br>Test .0125 amp. |                                     |
| Outer<br>wdg.<br>(500 ohms).                     | Test .020 amp.  |                                     |                                     |
| E828<br>(B)                                      | Special Requirements to insure fast operation.<br>Readj. .0095 amp.<br>Test .010 amp.<br>W.C.C. .075 amp.<br>(Armature travel .015"). | Readj. .0065 amp.<br>Test .006 amp. |                                     |
| E1173<br>(CI-2)                                  | Readj. .021 amp.<br>Test .025 amp.<br>W.C.C. .029 amp.  | Readj. .012 amp.<br>Test .011 amp.  |                                     |
| E1205<br>(TR)<br>Inner<br>wdg.                   | Readj. .015 amp.<br>Test .018 amp.<br>W.C.C. .021 amp.  | Readj. .010 amp.<br>Test .0095 amp. |                                     |
| E1359<br>(P)                                     | Readj. .017 amp.<br>Test .023 amp.<br>W.C.C. .029 amp.  |                                     | Readj. .002 amp.<br>Test .0019 amp. |

NOTE: To prevent chattering, the "make-  
before-break" spring combination  
of this relay shall be so adjust-  
ed that the spring which normal-  
ly makes on the back contact will  
give the greatest possible contact  
pressure against the back contact.

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY

|   | <u>OPERATE</u>  | <u>NON-OPERATE</u>                  | <u>RELEASE</u>                      |
|---|---|-------------------------------------|-------------------------------------|
| E1370<br>(CI)                                   | Readj. .027 amp.<br>Test .035 amp.<br>W.C.C. .043 amp.  |                                     | Readj. .003 amp.<br>Test .0015 amp. |
| E1439<br>(SL)<br>Inner<br>wdg.<br>(34<br>ohms). | Test requirement of inner winding is proportional<br>to test requirements of windings in series.<br>Readj. .074 amp.<br>Test .095 amp.<br>Hold:<br>W.C.C. .129 amp. | Readj. .050 amp.<br>Test .0475 amp. |                                     |
| Wdgs.<br>in series<br>aiding.                   | Test .027 amp.<br>W.C.C. .032 amp.  |                                     |                                     |

ENG.--TPI:ML.  
2/26/22.

CHK'D.--ACIH:CWP

APPROVED - C.L. SLUYTER, G.M.L.

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January 10, 1911

GENERAL INSTRUCTIONS

THESE INSTRUCTIONS ARE TO BE READ BY THE CANDIDATE BEFORE THE EXAMINATION

| NAME       | CLASS | MARKS | REMARKS |
|------------|-------|-------|---------|
| John Doe   | 1st   | 85    |         |
| Jane Smith | 2nd   | 78    |         |
| ...        | ...   | ...   | ...     |

THESE INSTRUCTIONS ARE TO BE READ BY THE CANDIDATE BEFORE THE EXAMINATION